CLAIMS

1. A method of producing a micro-fluidic structure element, the method comprising:

(a) providing a mould assembly for moulding a micro-structured element; said mould assembly comprising a first and second mould die together forming a die cavity, said first and/or said second mould die comprising:

(i) a mould surface, preferably of metal such as steel, bronze, beryllium-copper alloy, or moulding die aluminium alloy, comprising a micro-structured mould surface (705), and

(ii) one or more core pins extending between said first and second mould die across said die cavity,

(b) applying a moulding material to said die cavity, said moulding material preferably being a thermo plastic, more preferably a thermo plastic selected from the group comprising PS, PC, PMMA,COC, PP, PETG, PE, PA, ABS, POM, PUR, PVC, and TOPAS;

(c) allowing said moulding material to consolidate; and

(d) ejecting said consolidated moulding material from the die cavity.

2. The method according to claim 1 wherein said mould surface comprises a material selected from the group com-

prising metal, preferably nickel; metal alloy, preferably steel; semiconductor, preferably silicon; ceramic, preferably alumina.

3. The method according to claim 1 or 2 wherein one of said first and second mould dies, or both, comprises a micro-structured mould surface and a non-micro-structured mould surface.

4. A method according to any one of claims 1-3 wherein said one or more core pins comprise resilient means selected from the group consisting of a mechanical spring, a hydraulic expander, a pneumatic expander, an elastic material, preferably rubber, preferably rubber, or a soft plastic such a polyamide, e.g. nylon® PA-6, PA-6.6, PA-9, PA-10, PA-11, PA-12.

5. A method according to any one of claims 1-4 wherein said first and/or said second mould die comprises a releasable structural element to be released into said moulding material during application or consolidation thereof, or to be released onto said consolidated moulding material.

6. A micro-fluidic structure element obtainable by the method as defined in claims 1-5.

7. A mould assembly for moulding a micro-structured element of a micro-fluidic structure, said mould assembly comprising:

(a) a first mould die;
(b) a second mould die;

(c) an adjustable support for supporting said first and said second mould dies for relative movement towards and away from each other between a closed and an open mould position;

(d) said first or second mould dies comprising at least one core pin engaging said other of said first and second mould dies in said closed position;

wherein said first and/or second mould dies comprise a wholly or partly micro-structured mould surface.

8. The mould assembly according to claim 7 wherein said microstructured mould surface comprises engagement means for engaging said at least one core pin.

9. The mould assembly according to claim 8 wherein said engagement means comprises a protrusion of said micro-structured mould surface.

10. A mould assembly according to any one of claims 7-9 wherein said one or more core pins comprise resilient means selected from the group consisting of a mechanical spring, a hydraulic expander, a pneumatic expander, an elastic material, preferably a rubber, or nylon® PA-6, PA-6.6, PA-9, PA-10, PA-11, PA-12.

11. A micro-fluidic structure element, the element comprising a first outer face (101) and a second outer face (108), said first and/or said second outer face comprising at least one micro-structure for at least one micro-fluidic function (103, 109), and said first and

said second outer faces being in fluid communication by at least one through-going aperture (107).

12. The element according to claim 11 wherein said first and second outer faces are substantially orthogonal to said through-going aperture.

13. The element according to claim 11 or 12 said element is prepared by moulding, preferably injection moulding, more preferred compression injection moulding.

14. An element according to any one of claims 11-13 wherein the element in form of a monolithic element.

15. An element according to any one of claims 11-13 wherein the element is composed by two or more structure elements.

16. An element according to any one of claims 11-15 wherein said first and second outer faces comprises wholly or partly functionalised surfaces.

17. The element according to claim 16 wherein said wholly or partly functionalised surfaces have been functionalised by surface treatment, preferably by a physical and/or chemical treatment, more preferably by plasma treatment, heat treatment, corona discharge treatment, gaseous combustion treatment, irradiation treatment; or by surface coating, preferably by plasma polymerisation deposition, and/or metallization.

18. An element according to any one of claims 11-17 said first and/or said second outer face comprising at least one additional element (605).

19. The element according to claim 18 wherein said at least one additional element is selected from the group consisting of an insert, preferably a MEMS component, more preferably a micro-structured chip (605), a printed circuit board (PCB); an adhesive layer; and an intermediate layer, preferably a membrane, sheet, or foil.

20. The element according to claim 18 or 19 wherein said at least one additional element is fixed to said first and/or second outer faces, preferably by incorporation therein or adhesion thereto.

21. An element according to any one of claim 18-20 wherein said additional element comprises a material selected from the group consisting of a metal; a semiconductor, preferably silicon; a ceramic; a glass; a polymer; a flexible membrane, preferably rubber.

22. An element according to any one of claims 11-21 wherein said at least one through-going aperture is in fluid communication with a micro-structured open cavity, preferably a well or channel.

23. An element according to any one of claims 11-22 wherein said first outer face and/or said second outer face comprises one or more open structures in the millimetre region.

24. An element according to any one of claims 11-23 wherein said first outer face and/or said second outer face comprises a fluidic coupling means for coupling to an external fluid conduit, preferably a coupling means comprising a luer-lock system, in particular a luer for soft tubing, most preferred a integral fluidic coupling means.

25. An element according to any one of claims 11-24 wherein said first outer face and/or said second outer face comprises one or more open sub-millimetre structures, preferably in the range of 0.1 µm to 5 mm, more preferably 2 µm to 0.8 mm.

26. An element according to any one of claims 11-25 wherein said first outer face and/or said second outer face comprises at least one micro-structure for at least one non-micro-fluidic function.

27. The element according to claim 26 wherein said at least one non-micro-fluidic function comprises a structure for display of information, preferably one or more identification marks, such as well code marks, or tube connector numberings.

28. An element according to any one of claims 11-27 wherein said at least one non-fluidic function comprises a positioning structure for positioning and temporary fixation of a cover element, preferably a guiding pin, a guiding edge, or a guiding indentation.

29. An element according to any one of claims 11-28 wherein said first outer face and/or said second outer face comprises at least one micro-structure providing a lab-on-a-chip function.

30. The element according to claim 29 wherein said lab-on-a-chip function consists of means for one or more micro-fluidic operations selected from the group consisting of:

sample preparation,

sample delivery to a sensor,
optical access for visual inspection or optical measurement,
filtering,
intersecting fluidic channels for sample plug injection,
reservoirs for storing a fluid,
flow switches for switching fluid flows from one channel to another,
fluid mixers for mixing one or more fluid flows,
cell incubators,
cell sorters for sorting cells, and
cell analysing.

31. An element according to any one of claims 11-30 wherein the element is substantially planar.

32. A micro-fluidic structure, the structure comprising:

at least one micro-fluidic structure element as defined in claims 11-31; and

at least one cover element;

said first and/or second outer faces of said at least one micro-fluidic structure element being wholly or partly covered by said at least one cover element.

33. The structure according to claim 32 wherein said at least one cover element is micro-structured.

34. The structure according to claims 32 or 33 wherein said at least one micro-fluidic structure element and/or said at least one cover element comprises mating means for positioning thereof with respect to each other.

35. A structure according to any one of claims 32-34 wherein said at least one micro-fluidic structure element and said at least one cover element form one or more fluidic cavities or cavity systems, preferably a fluid conduit, a closed fluid channel, a fluid reservoir, or combinations thereof.

36. A structure according to any one of claims 32-35 wherein said at least one cover element comprises wholly or partly an element exhibiting a property selected among the group consisting of chemical resistance, mechanical flexibility, gas permeability, water impermeability, optical transparency, releasable adhesion.

37. A structure according to any one of claims 32-36 wherein said at least one cover element comprises a material selected from the group consisting of a thermo plastic selected from the group comprising PS, PC, PMMA, COC, PP, PETG, PE, PA, ABS, POM, PUR, PVC, and TOPAS.

38. A structure according to any one of claims 32-37 wherein said fluidic cavity wholly or partly exhibits a cross section selected from the group consisting of polygonal, triangular, rectangular, quadratic, hexagonal, elliptical, circular, semi-circular, or a combination thereof, said cross section being constant or varying in depth and width.

39. A structure according to any one of claims 32-38 wherein said at least one cover element is substantially planar.

40. A method of producing a standardized micro-fluidic structure element, the element comprising a standard face and a use-adapted face, the standard face having a predetermined number of micro-fluidic functions, preferably fluidic conduit coupling means, and the use-adapted face having at least one predetermined micro-structure for at least one predetermined micro-fluidic function, the micro-fluidic functions of the standard face being in fluid communication with the at least one predetermined micro-fluidic function on the use-adapted face, the method comprising:

(a) providing a mould assembly for moulding a micro-structured element, as defined in claims 11-31; said mould assembly comprising:

(i) a first and second mould die forming a die cavity, said first mould die comprising a micro-structured and/or macro-structured mould surface of the predetermined number of micro-fluidic functions of the standard face and; and second mould die comprising a micro-structured and/or macro-structured mould surface of the at least one predetermined micro-fluidic function of the use-adapted face;

(ii) one or more core pins extending between said first and second mould die across said die cavity;

(b) applying a moulding material to said die cavity;

(c) allowing said moulding material to consolidate; and

(d) ejecting said consolidated moulding material from the die cavity.

41. Use of a micro-fluidic structure as defined in claims 32-39, as produced from one or more micro-fluidic structure elements as defined in claims 11-31, or as produced by a method as defined in claims 1-5, in producing a micro-fluidic system with lab-on-a-chip operation of a laboratory analysis selected from the group consisting of analytical separation, analytical measurement, cell analysis, DNA sequencing, and protein sequencing.

42. Use of a micro-fluidic structure as defined in claims 32-39, as produced from a micro-fluidic structure elements as defined in claims 11-31, or as produced by a method as defined in claims 1-5, in producing a micro-fluidic system with lab-on-a-chip operation of a laboratory synthesis selected from the group consisting of nucleotide synthesis, protein synthesis, and cell propagation.